How to build competencies for data driven business -Keys for success and seeds for failure

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Abstract: Data analysis has a vast potential for innovations but there is a severe shortage of data scientists. How to create competencies and update company's competitive edge into the era of data driven business with impact? The article describes a program Data Driven Business in which data analysis and service design were trained to the teams from companies to gain impact - from education into skills in action. The course with real life case project proved to be efficient. As a results of the 14 week coaching course, 58% of companies had launched a new product or service in the market within six months from the end of the course. The paper introduces examples of services which were developed during the coaching course. It also sums up key findings and experiences which seem to distinguish those teams which managed to launch a release from those which did not.

Keywords: Data intensive services; innovation platform; data analysis; service design; design thinking; service thinking; case projects; experiences; best practises; team building

1 Introduction

Data is the new oil for innovation in many ways, as we know. But what does it take to exploit data for insights and business? How to combine data analysis and design thinking into new competencies and business? There is a severe shortage of data scientist and students are hired straight from university class rooms. How the small and medium size companies could acquire the critical competencies needed for data driven business? Instead of recruiting, how about training current employees? What does it take to re-educate a coder to become a data scientist to make data analysis - or an old school business developer, product manager or marketing expert to become a service designer?

This paper introduces an innovation platform created as part of the EU funded program *Data Driven Business (DOB)* and describes results and experiences of a innovation course *DOB coaching* to train organizations the competencies needed to exploit data analysis, services thinking and design thinking.

2 DOB innovation platform and coaching course for data driven business

The aim of the program *Data Driven Business* (in Finnish, *Datasta oivalluksia ja bisnestä*, *DOB*,) was to help companies to exploit data analysis and service design to create new services and update their competitive edge. An innovation platform combining

data analysis and customer centric service thinking was customized and piloted in three working packages. One of the packages was *DOB coaching*.

DOB program was run during 1st of August 2016 and 31st of December 2018 by a by seven organizations:University of Tampere, Finnish Centre for Open Systems and Solutions COSS, University of Oulu, Laurea University of Applied Sciences, Metropolia University of Applied Sciences, City of Vantaa and TIEKE The Information Society Development Centre. The program got funding also from City of Tampere, Hartela Pohjois-Suomi Oy and Ministry of Transport and Communications as well as from EU through Uudemaanliitto.

DOB innovation platform

DOB innovation platform is a general platform to solve problems and create new solutions exploiting data analysis and design thinking.

Figure 1 DOB platform for innovation



The first phase in DOB innovation platform is to define the problem to be solved or issue to be explored and examined. Next phase is identify the data which might have relevance in order to better understand the issue and finding insights using data analysis. The data may be owned by organizations involved or open data published by government or municipalities for instance data gathered and published by Helsinki Region Infoshare.

Data analysis

Data analysis is a process of examining, cleaning, transforming and modelling data with the goal of discovering useful information for understanding the issue and making more informed decisions and also finding valuable insights for innovation. (Pyle, 1999), (Theodoridis, 1993)

After identification of relevant data sources comes the often tedious phase of preparing the data to be analysed. The data has to be gathered from different sources and stored using appropriate data security mechanisms. In case of confidential data for instance personal data, data must be anonymized to protect data privacy. In order to create a consistent data matrix to be analysed, the data has to be technically prepared. Data preparation phase includes data cleaning and transformation. Data cleaning is the process of detecting and correcting or removing corrupt or inaccurate records from the data set. Data cleaning involves activities like harmonization and standardization of data.

After cleaning phase the data will be transformed into desired format and structure in order to explore the data and run the analysis using different methods. The analysis methods used in DOB coaching were descriptive analysis, diagnostic analysis and predictive analysis. Descriptive analysis was used to understand the data – what has happened, what you can see straight from the data using statistical analysis for instance distributions with medians, percentiles and clusters. Diagnostic analysis was used to understand why something happened what had happened for instance by understanding correlations between phenomena. In DOB coaching course one company helped their customer to understand better the usage of their products. The analysis revealed how customers were able to exploit the products and helped the company to understand better the current status of their customers' operations. The results of the analysis helped to create relevant customer segments and to develop new services based on customer behaviour and needs.

Predictive analysis was applied to understand what will happen in the future. Both guided and unguided machine learning were trained and used. Predictive analysis is able to come out with a predictive model which foresees what will happen. The insights based on better understanding and findings provided by data analysis were then brought to the service design process. In DOB coaching course it was used for example in a case project to understand which drivers predict malfunction of a machine. This helped the company to create a predictive maintenance business model to minimize outage and maximize efficiency of the machines.

The analysis tools used in DOB coaching were R software to create statistical models and run analysis and MySQL for data base management. They are both open source software without a license fee.



Figure 2 DOB analysis process

Design thinking and service design

'Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success.' (Brown, 2018)

'Service design is all about taking a service and making it meet the user's and customer's needs for that service.' (Interaction Design Foundation, 2018)

DOB innovation platform exploits double diamond process for service design phase (Design Council, 2015). The process starts from understanding the issue with stakeholders involved: what does the customer do as well as other stakeholders which have a role in the value chain ('what is'). Key question is what is their ultimate aim and which are the pain points to achieve the aim? Next phase is to create ideas how to fix the issues and paint points, what is the dream? This 'what if' -phase sets the goal and defines the project. Service design continues again with an idea phase how to achieve the goal ('what wows?'). Different options are evaluated and most feasible one is chosen for delivery ('what works'). The delivery phase consists of fast trial-and-error activities to find the solution which meets the needs of the customer and is doable. Business plan sums up the offering describing how the organization will create value with the customer as part of customers every day life and processes. Business plan describes which are the key resources to deliver the solution, who are the partners needed and what is the business case, where does the money come from. Business model is needed when communicating with the stakeholders for instance to get buy-in from sponsors for investments.

The tool used in DOB coaching for co-creation was CoCoKosmos (Laurea, 2013). It was used in different phases – when understanding the current situation and planning for the future. Brainstorming with post-it notes was used for ideation and different visualizations and prototypes were used when sketching and designing the solution to be developed for delivery. The business model was created using Service Business Model Canvas. (Ojasalo and Ojasalo, 2016)



Figure 3 DOB service design process

rces: https://www.designcouncil.org.uk/ http://www.whatisdesignthinking.org/

3. DOB coaching course

The aim of DOB coaching course was to update companies' competencies by analysis and design thinking using DOB innovation platform. DOB coaching consisted of a six weeks joint education phase with lessons and rehearsals followed by a eight weeks real life case project which each company run by themselves to create a new service or product. The analysis part was prepared and trained by teachers from Tampere University, the service design part by teachers from Laurea. COSS was in charge for the whole coaching course having also a role of a business consultant in the case projects. The training material with rehearsal tasks and solutions and videoed lectures are published in the DOB Toolbox in the web site of the program. The material is licensed under the license 'cc by 4.0' and may be used by everyone also for commercial purposes.

The course started with an orientation meeting with each participating organization in order to understand their business and needs and and why they wanted to attend. The meeting helped also to set expectations for the course. Education phase was a series of joint sessions with lectures and rehearsals. There was 4 joint sessions for both data scientists and service designers and in addition 8 for data scientists only and 2 for service designers only. The lessons and rehearsals for data scientists totalled 44 hours and for service designers 27 hours. The education phase was followed by case project phase in which the teams run their real life project by themselves together with their value network of customers and suppliers. The case project started with a case-kick in which the challenge was defined and the project plan with goal, actions with schedule and resources was agreed. The case projects were supported by trainers having interventions and providing with support also as needed. After the course, a follow-up session was arranged after couple of months to understand how the case project had proceeded and to give support for the development process.



Figure 4 DOB coaching course's structure

During the 18 month DOB program, three courses were run in three cities and 18 teams with 70 new data scientists and service designers were trained.

Figure 5 DOB coaching course had 18 teams from 19 organizations



The DOB coaching course was meant for companies. However also public sector organizations were accepted for the last course. The participants were chosen using first-in-first service principle. The course was free of charge for the participants and the amount of de minimis support for the participant was 9.500€ which was the estimated market value for the course. As a precondition for the course was that the to-be-data scientist had to have basic skills in mathematics and statistical science as well as hands-on skills in programming. The typical team consisted of 1-2 data scientists and 2-4 service designers. The extremities were one organization which sent a team of 6 people, while one small start-up company sent only one person to capture both skills. One organization sent two teams to subsequent courses.

Table	1	Orga	nization	ı in	DOB	coaching
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Sector, industry of the organization	on	Number of teams coached
Municipality		1
Research		1
Energy		1
Business services		14
Aviation		1
То	otal	18

4. Results

In six months after the two first courses seven teams (58%) had released a new service or product in the market. The third course ended only 23.11.2017, so equivalent data in not yet available (4.5.2018).

The products released so far from two first courses by 4.5.2018:

- Pilgrim.citynomadi.com routes for pilgrims in city of Tampere by Citynomadi Oy
- Digilastu document management for construction business by Metosin Oy
- Leadership-as-a-Service, HR services by Vincit Oyj
- Digital Pulse for customer experience management by Qentinel Oy
- MoveMe for welfare of employees and the company by Avarea Oy
- Enerkey for quality management in energy business by Enegia Oy
- Energy evaluation service for pumps by Viimatech Oy, Flowplus Oy and Flowbrainer Oy

Majority of the organizations trained have exploited new acquired competences also outside their case project, as part of their everyday business. Especially service design has been widely adopted. Among the participants there was many ICT companies. Majority of those companies has updated their consulting offerings geared by data analysis and service design but done that without explicit launch of their updated service. One team did not come out with a new service from their case project because the case project was put on hold but with a very good reason. The reason was that the data scientists which were just trained were recruited to a customer project which the company had won because of the new competencies trained in the DOB coaching.

The DOB course helped organizations to expand and strengthen their ecosystems. Once the total number of organizations taking part to the course was 19 in 18 teams, there were additional 14 organizations which participated in the case projects as customers and partners. Two companies, which met each others during the course have published a joint service development effort for health care and well being. Six companies have started r&d cooperation activities with a university.

DOB coach, case stories

Qentinel Oy is an ICT service company which works with businesses where quality provides an edge. Qentinel exploited DOB coaching course when developing a new service called 'Qentinel Pulse' to manage customer experience. Qentinel Pulse customized the framework and model which they had developed to understand how customer experience is born. Qentinel applies their model for customers by populating the model and its' customer experience metrix with relevant data. The model with relationships is created using machine learning to understand which drivers drive customer experience and how. As a result the customer gets a roadmap to be shared with the whole ecosystem how to manage the customer experience.

Vincit Oyj is a publicly listed ICT service company which is rewarded as the best employer for subsequential years. Vincit had two alternatives for the case project – an internal project to develop their HR and a customer case to help their industrial customer

to develop their business. Vincit chose the customer case but it did not end up to business that time. Instead Vincit turned to the other option, the HR opportunity and applied methods and lessons learned to develop their management system resulting 'Leadership-as-a-Service' (LaaS). Vincit's management system relies on self management, where the employee is in the focus. HR and management are there to help. Vincit LaaS was originally developed for Vincit's own needs, but the tool can be used in all kinds of organizations – not limited to IT organizations, but in every expert and production organizations. Implementation of the service relies strongly on service design. Right now, the tool is being used by over ten different organizations. LaaS is an online service that helps people to manage themselves more easily and effortlessly. It helps employees to set personal goals, and supports them in reaching the goals. When the service is used, data of usage is gathered and analysed and used to develop the service further.

Viimatech Oy is a start-up company providing ICT services for industrial customers. Viimatech gathered a consortium with two more companies which took part in the DOB coaching course. FlowPlus Oy is in maintenance business for pumps, FlowBrainer Oy is a business consulting company. Their joint case project dealt with predictive pump maintenance. Several new services are in the funnel, the first one launched was a service for smart forecast for outage and optimization of energy consumption and predictive analysis of pumps.

5. Experiences and best practises

Find below lessons learned based on case projects in the three DOB coaching courses.

Pick the right challenge: 'Don't love the solution - do love the problem'. One DOB course company decided to develop their help desk operation to improve the customer experience as part of issue management service. The goal was to solve the problem which was reported by the customer as fast as possible. Plenty of ideas were developed together with customers to improve the user experience. Data analysis was used to understand better customer point-of-view and problem solving process to find bottle necks. After a while the team went back to the ultimate goal and redesigned the challenge. The new goal was *not to fix* the problem as soon as possible but to *avoid the problem to happen at all*. The challenge was no more to develop help desk but to understand why issues occur in the first place and prevent them. How the problems can be identified and fixed before the customer comes across with the issue as a problem? And even better how the problems can be predicted so that they do not happen at all. Predictive analysis was used to identify patterns how the issues were born and to mend them permanently.

Pick the right team: All you need is a multidisciplinary team to combine data analysis, design thinking, substance experience and customer understanding.

As well as in every successful project also for a successful DOB case project a dedicated owner was a key critical factor. The owner should have a real relevant challenge which is worth solving – a problem to be fixed or a possibility to be explored and exploited. A sponsor is needed in order to have the resources needed in place. A rousing owner gets the team work for fun and creates a permissive atmosphere where

errors are not afraid. If one does not make errors the team has maybe not been brave enough and has probably lost some golden nuggets.

A DOB project team needs a **data analyst** to combine the data sources and a **data scientist** to run the analysis and who is able to dig out the insights which are evaluated together with the owner for their relevance. The **service designer** is the role with empathy who helps people to find problems and needs and comes up with solutions together with the stakeholders. **Service business designer** turns the invention into innovation with a business case.

When developing a service, product or process, the whole value chain needs to be involved. However one needs not have all the bits and pieces by oneself but have **partners** with competencies needed. The most important point of view in the development is the on of the **customer** with whom value is to be created and who will pay the bill.

The easiest and most straight forward way to get customer understanding to the team is to ask the customer to join the and help you to help him/her! Value chain is often long and it might be valuable to have also the customer of the customer involved. Customers usually appreciate that their supplier is active and asks to join. For example service design workshop does not take much from the customer but helps understand better their own business as part of the value chain. Cooperation deepens the relationship of the parties when serving better the ultimate customer. A team without a customer involved may be able to create a new service but does it really manage to create a perfect solution for the customer? A team with a customer involved in an early phase creates most probably a service which succeeds and once a customer has been involved from the very beginning it helps also the buy-in of the novelty. Service design is really done and ready only once the service is in use. Development with improvements is an on-going process.

Data analysis: Data analysis brings new understanding and may create valuable insights. The more granular and detailed raw data there is, the better for the data scientist find patterns and help understand the phenomena. Richest data bringing most surprising insights is a combination of various sources of raw data. To be able to join two different data sets there must be a joint data field in both data sets by which the two data sets can be combined. For example a unique personal id identifies a person and two data sets having the same id data can be joined. However joining various data sets is laborious and does not always succeed. The two data fields in two systems may have the same name but they may have different meaning. It may be that data is not accurate or values are missing. Preparation phase to refine the data to be analysed is usually the hard phase and does not always succeed. It happened in some DOB case project that 10% of data analysis was fancy data analysis itself and 90% was hard work to get the data matrix in place to be analysed. The better the data bases with decent data models have been designed, implemented and documented, the better yield with data analysis.

When gathering and processing data, data protection and data privacy requirements has to be met. Data security has to be solved in a proper way which is aligned with the nature of the data to be analysed. Data security requirements differ a lot between cases of for example, analysing only open data versus cases where health data or other sensitive data is involved. The EU's General Data Protection Regulation legislation, GDPR for data privacy has given new standards and framework for data privacy and usage of data. Personal data can be used only for the purposes agreed the person him/herself. Consent management to agree of data usage with people whose data is being analysed is crucial. In some cases, the current inconsistent legislation about using personal data in data analysis has discouraged organization from applying analysis at all. Organizations face risk of heavy fines if their data analysis process happens to be found flawed.

Finnish Ministry of Health and Welfare in collaboration with other public and private actors are developing a brand new system for social care, health and welfare having the individual in the centre. Data analysis has a major role when creating an integrated system with minimal sub-optimization. The GDPR sets requirements how personal data is to be exploited. That is why there is an urgent need to clarify proper conduct and process of data gathering and analysis to better exploit the valuable national social and health data. Legislation is currently being prepared to promote social and health data usage not only in research and education but also in innovation.

Service design: Companies with long tradition in the business and vast expertise may feel that 'we know everything what is worth knowing in the matter'. However, it is critical to be humble and realize that we do not know all. Curious attitude and interest in other people's business and ideas are key to success. Old school organizations often have a seemingly well-functioning models, designs and ideas how things and business have been done and a change in this current business model may be seen as a threat. But it is better to cannibalize old business by yourself than let others do it. For new entrants it is easier to be naive and straightforward and think out of the box and come out with ideas destroying the old design. Not only the suppliers but also customers get trapped in the current business models and service designs. Therefore, the right question to ask your customer is not 'what do you want' or 'what do you need' but 'what do you do, what is the aim, what are the pain points'? In that way it is possible to find totally new solutions rather than just extentions or modifications for current ones.

Service thinking culture: Transforming business from push to pull, from products or services to be produced to services helping the customer is revolutionary. Service thinking means joint value creation together with the customer. No matter if the company is making products or services, service thinking applies in both cases. A product is no more than a platform to create added value and the value is measured by the customer. Service dominant logic was born when researching services. (Vargo, 2004) That is why instead of talking about '*service dominant logic*' which refers to services, it would be more accurate to talk about '*customer centric logic*' referring to service thinking. In service thinking the right verb is 'to help' - not 'to sell'. Once the customer feels that he or she has been helped, money and business will follow. One has to find out what is the feasible earning model. The user of the service is not always the one who pays for it, as examples in social media with Facebook and Google show.

It takes time to make the cultural change to customer centric thinking in all activities in the organization and get every employee internalize its principles. In DOB coaching it proved to be a good idea to have several people to participate to the course in order to spread the insight and new thinking in the whole organization. It is difficult and time consuming to make a shift in organizational culture. Therefore one organization which participated in the DOB course wanted to have an eye-opening presentation of service and design thinking to all employees. It was much easier to walk the talk once everyone was familiarized with service thinking concepts instead of only a smaller dedicated team. **Management & leadership:** The team should have the time needed for the training and case project. In many cases important customer projects passed by the DOB coaching course which caused problems and delays in the case phase. Every organization which started the course passed it with only some of the individual students stepping down. Clearly, the more the DOB case project was in the core of the business, the better the results. Some companies had a motive for their case project already in place before the course started. They were determined and were most probably able to create a new service. However there were also companies which could manage the conflict situation when they were obliged to change their case project during the run and still got a new service launched. Those companies aimed further for sustainable change and were able to see beyond the low hanging fruit of creating just a new service or product but to update their core competencies in long run and create and new fruits on constant base.

'Don't be afraid of failure'. 'Be agile and fail fast'. One DOB coaching participant had already planned and prepared to augment their service assortment with a new service. The idea was evaluated in DOB workshop with paying customers and it proved out right away that customers were not eager to pay for such a service. A new direction was chosen to further develop the whole assortment. Having a customer involved in early phase of the development process helps avoiding false investments. In the DOB case mentioned, the intended service was actually decided to be developed but free of charge to lead to expanding customer base.

'Celebrate success, be loud and visible to get a positive spiral of success'. Stories 'making the the x' with ups and downs are interesting for the audience and useful to deepen the brand of x. For instance Vincit has told in public how they developed the Leadership-as-a-Service concept first to themselves. They started by asking from employees what do they want from HR, what kind of services they need? As a result they got rather traditional ideas for new services and add-ons to current ones. But when Vincit went a bit deeper in the employees life and every day challenges they made the breakthrough. For example they have changed the idea of the traditional development discussion upside down. The discussion the employee is not done necessarily with the manager but with a person which the employee chooses: for instance the CEO or a board member or a mentor outside the company. Vincit's HR has a lot of new services to help the employee to work better and feel better. For example if an employee has a baby who does not sleep well in nights, Vincit arranges a sleeping school to help the family.

6. Summary and the way forward

The article dealt with the innovation platform DOB and course DOB coaching to adopt data analysis and service design as part of organizations competitive edge. Both disciplines were fruitful when creating data driven services. However data analysis and service design differ significantly in nature. Learning and applying data analysis requires basic know-how in statistical science and mathematics. Also, it does not work out every time. It may prove out that the quality of data is not good enough the make decent data analysis. It may be that the cost to mend the issues with the data is too high, too laborious while the scarce ICT resources are stuck with other projects. In addition although the analysis may have succeeded technically it may happen that the findings do not have any relevance from business point of view. But once succeeding the benefit may be enormous. Insights from data analysis may be the core of a new service or product as was

the case with Qentinel or as a core for the whole business model as was the case with Viimatech.

In contrast to data analysis, service design and service thinking do not require any preconditions or studies. The idea is as old as the moral rule and principle 'treat others as you want you to be treated', which is common in all cultures. Basically service thinking is about helping others driven by empathy.

In short, data analysis is demanding and does not work out every time but sometimes it'll produce a true jewel whereas service design will succeed every time enabling fruitful cooperation.

DOBit network after DOB

DOB program ended by the end of December 2017. The participants wanted to continue cooperation and share ideas, experiences and best practises also after the program. This meant beginning of a network called DOBit. The network is open for everyone who wants to promote data analysis and service thinking. DOB coaching is being further developed and commercialized by COSS.

Further information

DOB program: https://coss.fi/projektit/dob/dob-in-english/ DOB toolbox https://coss.fi/projektit/dob/tyokalupakki/ (in Finnish) Helsinki Region Infoshare: (https://hri.fi/fi/) R software: https://www.r-project.org/about.html MySQL : https://www.mysql.com/ Qentinel Oy: https://qentinel.com/ Quentinel Pulse: https://qentinel.com/customer-experience-management/ Vincit Oyj https://www.vincit.fi/ Vincit LaaS: https://www.vincit.fi/ Vincit LaaS: https://www.vincit.fi/en/laas-en/ Viimatech Oy: https://www.viimatech.fi/ EU GDPR: https://www.eugdpr.org/ Ministry of Social Care and Health: http://stm.fi/en/secondary-use-of-health-and-socialdata

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